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Office of the Secretary
Federal Communications Commission
Washington, DC 20554

Dear Members of the Commission:

We write in response to FCC Notice of Proposed Rule Making concerning the Implementation of Section 309(j) of the Communications Act Competitive Bidding, PP Docket No. 93-252. We are submitting comments regarding proposed bidding systems for the licensing of personal communication services (PCS) bandwidth. Design of a bidding system for auction of airwave licenses must incorporate an array of factors resulting from the nature of airwaves as a commodity.

To begin we advance arguments in favor of first-price as opposed to second-price auctions, advantages that were not identified in the proposal outlined in your Notice. We then proceed to define a second-price auction method that effectively deals with the problem of bidding for groups of licenses. We believe that there are competing advantages for first- and second-price auctions. Unfortunately, the existing proposal suffers the weaknesses of second-price auctions without reaping their benefits with regard to bidding for groups of licenses.

We present remarks in two areas: (1) The advantages of first-price as opposed to second-price auctions, and (2) The design of an auction system that deals effectively with "combinatorial bidding," bidding on groups of licenses.

(1) Advantages of First-Price Auctions

We have several additional comments about the bidding procedure, all advocating the use of a first-price rather than a second-price pricing rule. The auction proposal argues that second-price bidding rules have a theoretical advantage over first-price rules because they assure that a good is sold to the bidder who values it most. However, auction theory suggests that there may be a cost in expected revenue from a second-price rule, even when bidders compete honestly. In the presence of risk aversion or disparities among bidders (e.g. where one is more likely to have a high value than the other, c.f. Maskin and Riley "Asymmetric Auctions," mimeo, Harvard University, 1989), first-price sealed-bidding

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promotes competition and yields a higher equilibrium revenue than any second-price rule.

The proposal also argues implicitly that any allocation which leads to resale is inefficient because the government would prefer to sell the item initially at the (higher) resale price. But it is generally impossible to impose the resale price in an initial auction. In fact, resale can also facilitate competition and drive up the price in the initial auction. Consider a situation in which firm A is known to have value 10 for a license and firm B is known to have value 1 for it. Then the possibility of resale could cause B to bid as high as 10 since it can resell the item to A for a profit.

Tacit collusion and manipulation pose great problems for second-price and oral auctions beyond those discussed in the proposal. The New Zealand bidding example cited in footnote 33 demonstrates that sealed-bid second-price auctions can produce outcome with very strange appearances. The winning bidder is not penalized for bidding beyond its maximum willingness to pay if other bidders are not making competitive bids. That leaves sealed-bid auctions subject to the following sort of manipulation. Firm A lets it be known that it will bid an outrageous amount for one license, and then realizing that they have no chance of winning that license, other firms turn their attention to evaluating the profitability of other licenses with the result that firm A wins the original license at a bargain price (despite the exorbitant bid). A similar procedure would allow a cartel of firms to protect themselves against defections by their members in determining the allocation of a number of licenses to its members. That is, second-price bidding induces bidders to reveal their true values so long as their competitors are bidding their honest values, but is not robust to coordinated bidding as described above. In contrast, first-price auctions are more difficult to manipulate because the winning bidder pays the price it names. Any attempt by a cartel or a firm to collude in a first-price auction always leaves open the possibility that a competitor will defect to win the auction with a higher bid.

Oral auctions are sensitive to a different type of manipulation. While it is impossible to coordinate tacit collusion by having one bidder submit an excessive bid, oral auctions actually support explicit collusive schemes because a cartel can monitor the actions of its members throughout the (public) bidding. Furthermore, bidders in oral auctions may be able to intimidate their competitors through strategic choice of bids (Avery, "Strategic Jump Bidding in English Auctions," mimeo, Harvard University, 1993; Hirshleifer and Daniel, "A Theory of Costly Sequential Bidding," mimeo, UCLA, 1993). By raising the bid by a large amount to start the auction, an individual bidder may signal his desire to win the auction to other bidders and thus deter them from competing on that license. It is said that J. Paul Getty always won auctions for paintings cheaply by such actions, and large firms could well try to prey on small firms with similar strategies in the bidding for licenses. By this reasoning, we advocate a single bid system rather than the multiple bid system discussed in footnote 27.

(2) Combinatorial Bidding -- Bidding on Groups of Licenses Through Second-Price Auctions

The efficient allocation of licenses requires that parties be able to bid on groups of licenses. If preferences are merely additive, there is no difficulty, and auctioning on a district-by-district basis would be efficient. However,such preferences may be superadditive. For example, a party might be willing to pay 8 for a license in A, 5 for a license in B, but 15 for a license in both A and B. They could also be subadditive. The most common case would occur when a party wanted a license in one of two districts, but not both, perhaps because it could not afford or manage both. Thus, that party might value a C license at 10, a D license at 9, but a license in both districts merely at 12, much less than the sum of the two.

If potential bidders have superadditive or subadditive preferences, efficiency can not be achieved if licenses are bid for sequentially. The most elementary difficulty is that a bidder will not know how much to bid for on E not knowing what price subsequent item F will fetch. The resolution of this problem is to have all bidders submit sealed bids on all licenses, single or combination in which they have an interest. The licenses are then awarded, singly and in combination, to maximize the total value of the allocation. This will result in a large, albeit straightforward integer programming problem. The parties are then charged an amount for the licenses they receive.

The essence of the scheme we propose is a charge scheme that makes it incentive compatible for the parties to bid their true preferences. The scheme is based upon the well known Groves-Clarke mechanism. It is a generalization of a sealed-bid, second-price auction. The generalization consists of putting multiple items up for sale, with explicit recognition of interdependence of preferences.

We shall first illustrate the mechanism, and then briefly describe its properties. We consider an auction with one license available in each of three regions. There are four bidders. The entries in the table represent their valuations for alternative licenses, single and in combination.

Bidders' Valuation of Licenses

Bidder	District						
	1	2	3	1&2	1&3	2&3	1&2&3
A	8	8	0	10	--	--	--
B	7	6	0	--	--	--	--
C	4	6	7	11	12	16	22
D	0	0	6	--	--	--	--

Note that A's preferences are subadditive. He wishes either a license in District 1 or District 2, but would only pay 10 for a license in both, perhaps due to capital constraints. B's preferences are simply additive. C's preferences are superadditive. She values all combinations of licenses above what they would be worth merely be adding values together. D is only interested in a license for 3.

The licenses are now awarded to maximize the total value (MTV) received. We call this the MTV Allocation. The MTV Allocation is accomplished, as shown by the circles, by awarding license 1 to A, and licenses 2 and 3 to C. The total value reaped is 24. Note that is was not essential to define in advance which districts would be combined together. The combinations yielding maximum value are defined in resolving the bidding process. Note also that A is awarded a license in 1, not 2, even though his bid exceeds the second highest individual valuation by more in District 2.

That the goal should be to maximize value is not in question. This allocation is assuredly correct. The challenge is to find a payment system that leads the bidders to express their honest preferences. That is, they can derive no benefit from bidding anything other than their true preferences. Such a system is called incentive compatible.

The efficient system merely charges each individual the amount he/she denies to the other bidders. This amount is calculated by computing how much the other players would reap absent that bidder. Then the amount those players reap in the MTV Allocation is computed. The difference is the amount that player is charged. A player who receives no license is charged nothing, since that player does not diminish the total valuation going to other players.

The diagram below shows the charges in the particular example given:

	Total Value to Other Players		Charge to Player
	Absent	With	
Player			
A	23	16	7
B	24	24	0
C	21	8	13
D	24	24	0

The first column indicates the amounts the other players receive with the player in the left column absent. Thus, B, C and D reap a total of 23 with A absent. The second column tells how much the other players receive in the MTV Allocation. The third column merely represents the difference between the first two.

With a charge to 7 for A and 13 for C, both players will have the incentive to tell the truth. Note that if either player raised his/her bid on the licenses they won that would have no effect on the amount they pay. That is because they pay on the basis of the value they deny others.

(3) Summary

There are significant advantages to first-price auctions in terms of discouraging collusion. If the Commission believes collusion may be a significant problem, it might wish to focus on the first-price auction model. A complementary virtue is that first-price auctions yield greater revenue under a range of reasonable circumstances, such as bidder risk aversion. Second-price auctions have captured the interest of economists and game theorists in recent years, in part because of the elegant ways in which they encourage truthful revelation of preferences. But most such studies have not examined how second-price auctions would work in practice.

The principal advantage of second-price auctions in the context of bidding for licenses from the FCC is that a variant of them can effectively deal with bidding on groups of licenses. Either subadditive or superadditive preferences can be accommodated. Subadditive preferences may be the greater concern if we wish to promote competition. We want bidders to have the incentive to bid on as many different licenses as possible; yet such bidders need protection against spending too much on license E should they happen to be able to purchase F as well. With respect to superadditive preferences, a significant advantage of the proposed system is that it automatically determines the appropriate packaging of geographic areas. The Groves-Clarke style mechanism outlined above could readily be implemented.

We commend the FCC for proceeding in a sophisticated fashion to foster this New Auction Law. We only hope that it is able to deal effectively with the design of the auction. To auction the use of the radio spectrum, rather than give it away, reflects a major advance. Now it is essential to design the auction in a manner that best serves the public interest. Careful attention to the issues laid out above is essential for an effective auction design.

Sincerely yours,

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